

UNITED STATES DEPARTMENT OF COMMERCE National Oceanic and Atmospheric Administration

NATIONAL MARINE FISHERIES SERVICE Northwest Region 7600 Sand Point Way N.E., Bldg. 1 Seattle, WA 98115

Refer to: 2003/01504

June 10, 2004

Mr. Lawrence C. Evans Portland District, Corps of Engineers CENWP-OP-GP (Mr. Ron Marg) P.O. Box 2946 Portland, Oregon 97208-2946

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery and Conservation Management Act Essential Fish Habitat Consultation for the City of Warrenton, Public Works Department, Waste Water Treatment Plant Improvements, Columbia River Basin, Clatsop County, Oregon (Corps No. 200300651)

Dear Mr. Evans:

Enclosed is a biological opinion (Opinion) prepared by the National Marine Fisheries Service (NOAA Fisheries) pursuant to section 7 of the Endangered Species Act (ESA) on the effects of the proposed City of Warrenton (the City) Public Works Department Waste Water Treatment Plant Improvements in Clatsop County, Oregon. In this Opinion, NOAA Fisheries concludes that the proposed action is not likely to jeopardize the continued existence of twelve species of ESA-listed salmonid fishes, or destroy or adversely modify their designated critical habitat. As required by section 7 of the ESA, NOAA Fisheries included reasonable and prudent measures with non-discretionary terms and conditions that are necessary to minimize the effects of incidental take associated with this action. NOAA Fisheries acknowledges discharge of pollutants from the City's waste water treatment plant may cause take of listed salmon and steelhead.

The interrelated action of discharging effluent through the new deep-water outfall is analyzed in this Opinion for the purpose of determining jeopardy but, because the U.S. Army Corps of Engineers (Corps) does not have regulatory authority regarding discharge of effluent pollutants, the effects of discharged pollutants on listed salmon and steelhead and designated critical habitat is not included in the incidental take statement for these Corps permits. Any effluent discharged is subject to take prohibitions under section 9 and rules promulgated for section 4(d) of the ESA.

This document also serves as consultation on essential fish habitat pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations (50 CFR Part 600). NOAA Fisheries concludes that the proposed action will adversely affect designated EFH for Pacific salmon, groundfish and coastal pelagic species. As required by section 305(b)(4)(A) of the MSA, included are conservation recommendations that



NOAA Fisheries believes will avoid, minimize, mitigate, or otherwise offset adverse effects on EFH resulting from the proposed action. As described in the enclosed consultation, 305(b)(4)(B) of the MSA requires that a Federal action agency must provide a detailed response in writing within 30 days after receiving an EFH conservation recommendation.

Please direct any questions regarding this consultation to Robert Anderson of my staff in the Oregon Coast/Lower Columbia River Branch of the Oregon State Habitat Office at 503.231.2226.

Sincerely,

D. Robert Lohn

FI Michael R Crouse

Regional Administrator

Endangered Species Act - Section 7 Consultation Biological Opinion



Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

City of Warrenton, Public Works Department, Waste Water Treatment Plant Improvements Columbia River Basin, Clatsop County, Oregon (Corps No. 200300651)

Agency: U.S. Army Corps of Engineers

Consultation

Conducted By: NOAA's National Marine Fisheries Service,

Northwest Region

Date Issued: June 10, 2004

Fil Michael R Crouse

Issued by:

D. Robert Lohn

Regional Administrator

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TABLE OF CONTENTS

1.	INTROD	UCTION	<u>1</u>
	1.1	Background and Consultation History	
	1.2	Proposed Action	
		1.2.1 Temporary Access Road	
		1.2.2 Waste Water Treatment Plant Reconstruction	
		1.2.3 Effluent Outfall Construction	
		1.2.4 Conservation Measures/Best Management Practices	3
	1.3	Description of the Action Area	
2.	ENDANG	GERED SPECIES ACT	<u>3</u>
	2.1	Biological Opinion	<u>3</u>
		2.1.1 Biological Information and Critical Habitat	<u>4</u>
		2.1.2 Evaluating Proposed Actions	<u>14</u>
		2.1.3 Biological Requirements	
		2.1.4 Environmental Baseline	
		2.1.5 Analysis of Effects	
		2.1.5.1 Effects of Proposed Action	<u>16</u>
		2.1.5.2 Effects on Critical Habitat	
		2.1.5.3 Interrelated Actions	<u>19</u>
		2.1.5.4 Cumulative Effects	
		2.1.6 Conclusion	
		2.1.7 Reinitiation of Consultation	30
		2.1.8 Conservation Recommendations	
	2.2	Incidental Take Statement	
		2.2.1 Amount or Extent of Take	
		2.2.2 Reasonable and Prudent Measures	
		2.2.3 Terms and Conditions	<u>33</u>
3.	MAGNU	SON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT .	<u>34</u>
	3.1	Background	<u>34</u>
	3.2	Identification of EFH	<u>35</u>
	3.3	Proposed Action	
	3.4	Effects of Proposed Action	<u>36</u>
	3.5	Conclusion	
	3.6	EFH Conservation Recommendations	<u>36</u>
	3.7	Statutory Response Requirement	
	3.8	Supplemental Consultation	<u>36</u>
4	I ITER A	TURE CITED	38

1. INTRODUCTION

The Endangered Species Act (ESA) of 1973 (16 USC 1531-1544), as amended, establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with U.S. Fish and Wildlife Service and NOAA's National Marine Fisheries Service (NOAA Fisheries), as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitats. This biological opinion (Opinion) is the product of an interagency consultation pursuant to section 7(a)(2) of the ESA and implementing regulations found at 50 CFR 402.

The analysis also fulfills the essential fish habitat (EFH) requirements under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan. Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2)).

1.1 Background and Consultation History

On December 12, 2003, NOAA Fisheries received a letter from the U.S. Army Corps of Engineers (Corps) requesting formal consultation pursuant to section 7(a)(2) of the ESA, and EFH consultation pursuant to section 305(b)(2) of the MSA for the proposed City of Warrenton (the City) Public Works Department Waste Water Treatment Plant Improvements, in Clatsop County, Oregon. A biological assessment (BA) describing the proposed action and its potential effects was submitted with the letter. In the BA, the Corps determined the proposed action was likely to adversely affect the following ESA-listed species: Snake River (SR) steelhead (*Oncorhynchus mykiss*), Upper Columbia River (UCR) steelhead, Middle Columbia River (MCR) steelhead, Upper Willamette River (UWR) steelhead, Lower Columbia River (LCR) steelhead, SR spring/summer-run Chinook salmon (*O. tshawytscha*), SR fall-run Chinook salmon, UCR spring-run Chinook salmon, UWR Chinook salmon, LCR Chinook salmon, Columbia River (CR) chum salmon (*O. keta*), and SR sockeye salmon (*O. nerka*). The Corps also found the proposed project may adversely affect designated EFH.

1.2 Proposed Action

The proposed action is issuance of permits by the Corps under section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act to the City. Construction activities would include construction of a temporary access road, waste water treatment plant reconstruction, installation of a deep-water outfall, and proposed conservation measures and best management practices. Specific elements of the proposed action are described below.

1.2.1 Temporary Access Road

The Corps proposes to authorize construction of a 20-foot wide, 188-foot long temporary access road. Construction of the road would require excavation of approximately 500 cubic yards (cy) of material and placement of 1,080 cy of rock in a palustrine wetland (0.17 acres). The excavated material would be stockpiled onsite and reinstated after the temporary road is removed. All disturbed areas would be replanted with native plants following removal of the temporary road. Construction of the temporary access road would occur in an isolated wetland with no fish access.

1.2.2 Waste Water Treatment Plant Reconstruction

Once the temporary access road is constructed, modifications to the existing waste water treatment plant would occur. Construction activities would include building a dike within the treatment cells, grading, and filling. All work would occur within the existing footprint of the waste water treatment plant.

1.2.3 Effluent Outfall Construction

The Corps proposes to authorize the installation of a new deep-water outfall into the Columbia River. The deep-water outfall would consist of an 18-inch outside diameter high-density polyethylene pipe, and measure approximately 3,500 feet in length (station +0.60± to station 51+65±). Installation of the deep-water outfall would begin near the waste water treatment plant effluent pump station at station +0.60±. The deep-water outfall pipe would be placed in the unnamed stream channel that flows into the Columbia River above grade for approximately 500 linear feet and continue above grade for an additional 250 linear feet in the salt marsh/tide flat stream channel (station 17+60±), where the pipeline would then be installed at a minimum of 6 inches below grade to its terminus in the Columbia River at station 51+65±. The outfall would be installed with one 35 linear foot, 8-port diffuser at an elevation of minus 35 feet mean lower low water (MLLW). Total fill below mean high tide equals 2,969 cy. The total area of fill impact equals 34,630 square feet.

The deep-water outfall would be installed using directional drilling technology. Directional drilling equipment would be staged near the waste water treatment plant effluent pump station or within the waste water treatment plant cells. Drilling fluids would be excavated and discharged into the waste water treatment cells and disposed off site. A catchment area consisting of a steel containment vessel would be established at the hole-through location in the Columbia River to minimize drilling fluids from entering the Columbia River. The pipeline would be pulled back using a barge anchored in the Columbia River.

1.2.4 Conservation Measures/Best Management Practices

NOAA Fisheries regards the conservation measures and best management practices included in the consultation request (BA p. 22-25) as useful and important to minimize adverse effects to ESA-listed species and their habitats, and considers them to be an integral part of the proposed action. Conservation measures in the following categories would apply (see consultation proposal for details): (1) Site rehabilitation, (2) in-water work timing restrictions (November 1 through February 28), (3) staging/material storage, (4) noise abatement, (5) groundwater protection, (6) directional drilling restrictions, (7) spill containment and control, (8) vehicle staging and fueling, (9) turbidity minimization measures, (10) pollution and erosion control plan, (11) vehicle inspections, and (12) fish injury or mortality reporting.

1.3 Description of the Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area (project area) involved in the proposed action (50 CFR 402.02). For this consultation, NOAA Fisheries defines the action area as all estuarine and riverine habitats accessible to the subject species in the Columbia River from river mile 10 to river mile 11 south of the Federal navigation channel, and includes the unnamed tributary, the adjacent riparian zone, and Alder Cove. The proposed mixing zone for the City's deep-water diffuser is included in this Opinion for analysis, but is not part of the incidental take statement due to uncertainties and the lack of regulatory authority by the Corps. The mixing zone has been defined by the Oregon Department of Environmental Quality (ODEQ) as 100 feet for chronic (criterion continuous concentration) (CCC) criteria, and 10 feet for acute (criterion maximum concentration) (CMC) criteria. These mixing zone dimensions are horizontal dimensions measured from any diffuser port. Water quality standards for toxic pollutants must be met at the respective demarcations for chronic and acute criteria within the defined mixing zone.

2. ENDANGERED SPECIES ACT

2.1 Biological Opinion

This consultation considers the potential effects of the proposed action by the Corps on SR steelhead, UCR steelhead, MCR steelhead, UWR steelhead, LCR steelhead, SR spring/summerrun Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon, UWR Chinook salmon, LCR Chinook salmon, CR chum salmon, and SR sockeye salmon. Species' listing dates, critical habitat designations, and take prohibitions are listed in Table 1. The objective of this consultation is to determine whether the proposed action is likely to jeopardize the continued existence of the ESA-listed species, or destroy or adversely modify designated critical habitat for, SR fall Chinook, SR spring/summer Chinook salmon, or SR sockeye salmon. This consultation is conducted pursuant to section 7(a)(2) of the ESA and its implementing regulations (50 CFR 402).

2.1.1 Biological Information and Critical Habitat

Snake River (SR) Fall Chinook Salmon

The SR fall Chinook salmon evolutionarily significant unit (ESU) once spawned in the mainstem of the Snake River from its confluence with the Columbia River upstream to Shoshone Falls (RM 615). The spawning grounds between Huntington (RM 328) and Auger Falls (RM 607) were historically the most important for this species. Only limited spawning activity occurred downstream of RM 273 (Waples *et al.* 1991a), about one mile below Oxbow Dam (Waples *et al.* 1991a). However, irrigation and hydropower projects on the mainstem Snake River have inundated, or blocked access to, most of this area in the past century. The construction of Swan Falls Dam (RM 458) in 1901 eliminated access to much of this habitat and the completion of Brownlee Dam in 1958 (RM 285), Oxbow Dam in 1961 (RM 272), and Hells Canyon Dam in 1967 (RM 247) blocked access to the rest.

Since 1991, spawning has been limited primarily to the mainstem Snake River between a point upstream of Lower Granite Reservoir (RM 149) and Hells Canyon Dam (RM 247), and the lower reaches of the Grande Ronde, Clearwater, and Tucannon Rivers, tributaries to the Snake River. Redds in the Clearwater River have been observed from its mouth to slightly upstream of its confluence with the north fork (about 40 miles).

No reliable estimates of historical abundance are available (Waples *et al.* 1991b), but because of their dependence on mainstem habitat for spawning, fall Chinook have probably been affected to a greater extent by irrigation and hydroelectric projects than any other species of salmon in the Snake River basin. The mean number of adult SR fall Chinook salmon declined from 72,000 in the 1930s and 1940s to 29,000 during the 1950s. In spite of this, the Snake River remained the most important natural production area for fall Chinook in the Columbia River basin through the 1950s. The number of adults counted at the uppermost Snake River mainstem dams averaged 12,720 total spawners from 1964 to 1968; 3,416 spawners from 1969 to 1974; and 610 spawners from 1975 to 1980 (Waples, *et al.* 1991b). Most adult SR fall Chinook spend three years at sea before migrating up the Columbia and Snake Rivers between August and October (Waples *et al.* 1991b). Spawning occurs in the mainstem Snake River and in the lower parts of its major tributaries in between late October and mid-December, typically peaking in November (Myers *et al.* 1998). Fry emerge from the spawning beds from late March through early June. At present, the peak of the smolt outmigration usually occurs in July, however juvenile fall Chinook may be found migrating in the lower Snake and Columbia rivers from May through October. SR fall

In its comments on the draft USBR 1999 Biological Opinion, the State of Idaho commented that "it is generally accepted that peak juvenile Snake River fall Chinook migration historically coincided with the declining hydrograph following spring snowmelt" (Kempthorne 1999). However, Krzma and Raleigh (1970) observed that the migration of juvenile fall Chinook into Brownlee Reservoir in 1962 and 1963 began in mid-April, and ended by mid-June (roughly 75% of the migration took place during the second and third weeks of May in those years). Juvenile fall Chinook captured between mid-May and mid-June averaged 71, 81, and 79 millimeters in 1962, 1963, and 1964, respectively. Similarly, Mains and Smith (1964), who monitored the migration of Chinook salmon in the lower Snake River (RM 82) in 1954 and 1955, collected Chinook salmon fry (most likely those of fall Chinook salmon) migrating in March and April, and documented that the migration of Chinook salmon smolts was nearly complete by the end of June. The average length of fingerlings in June was 90.7 mm. Thus, the historic migration of fall Chinook salmon through the Snake River was more likely to have occurred between late-May and late-June, nearer the peak of historical hydrograph.

Chinook typically exhibit an "ocean" type juvenile life history pattern, usually rearing in freshwater for only a few months before migrating to the ocean.

Table 1. Endangered and threatened pacific salmon and steelhead under NOAA Fisheries' jurisdiction in Oregon

Evolutionarily Significant	Final Rule E = Endangered T = Threatened	Critical habitat	Protective Regulations	
Unit		(Final Rule)	(Final Rule)	
Snake River fall	T: April 22, 1992;	December 28, 1993;	April 22, 1992;	
Chinook salmon	57 FR 14653	58 FR 68543	57 FR 14653	
Snake River spring/summer	T: April 22, 1992;	October 25, 1999;	April 22, 1992;	
Chinook salmon	57 FR 146531	64 FR 57399	57 FR 14653	
Snake River	E: November 20, 1991; 56	December 28, 1993;	ESA section 9 applies	
sockeye salmon	FR 58619	58 FR 68543		
Snake River	T: August 18, 1997;	N/A	July 10, 2000;	
steelhead	62 FR 43937		65 FR 42422	
Lower Columbia River	T: March 24, 1999;	N/A	July 10, 2000;	
Chinook salmon	64 FR 14308		65 FR 42422	
Upper Columbia River spring Chinook salmon	E: March 24, 1999; 64 FR 14308	N/A	ESA section 9 applies	
Upper Willamette River	T: March 24, 1999;	N/A	July 10, 2000;	
Chinook salmon	64 FR 14308		65 FR 42422	
Columbia River chum salmon	T: March 25, 1999; 64 FR 14508	N/A	July 10, 2000; 65 FR 42422	
Middle Columbia River steelhead	T: March 25, 1999; 64 FR 14517	N/A	July 10, 2000; 65 FR 42422	
Lower Columbia River steelhead	T: March 19, 1998; 63 FR 13347	N/A	July 10, 2000; 65 FR 42422	
Upper Willamette River steelhead	T: March 25, 1999; 64 FR 14517	N/A	July 10, 2000; 65 FR 42422	
Upper Columbia River steelhead	E: August 18, 1997; 62 FR 43937	N/A	ESA section 9 applies	

SR Spring/Summer Chinook Salmon

It is estimated that at least 1.5 million spring/summer Chinook salmon returned to the Snake River in the late 1800s, approximately 39 to 44% of all spring/summer Chinook in the Columbia River basin. Historically, Shoshone Falls (RM 615) was the uppermost limit to spring/summer Chinook migration, and spawning occurred in virtually all suitable and accessible habitat in the

Snake River basin (Fulton 1968 and Matthews and Waples 1991). The development of mainstem irrigation and hydroelectric projects in the mainstem Snake River basin have significantly reduced the amount of habitat available for spring/summer Chinook such that between 1950 and 1960, an average of 125,000 adults returned to the Snake River, only 8% of the historic estimate. An estimated average of 100,000 wild adults would have returned from 1964 to 1968 each year after adjusting for fish harvested in the river fisheries below McNary Dam. However, actual counts of wild adults at Ice Harbor Dam annually averaged only 59,000 each year from 1962 to 1970. The estimated number of wild adult Chinook salmon passing Lower Granite Dam between 1980 and 1990 was 9,674 fish (Matthews and Waples 1991). A recent 5-year geometric mean (1992 to 1996) was only 3,820 naturally-produced spawners (Myers *et al.* 1998). This is less than 0.3% of the estimated historical abundance of wild SR spring/summer Chinook.

SR spring/summer Chinook migrate through the Columbia River from March through July, and spawn in smaller, higher elevation streams than do fall Chinook. Fry generally emerge from the gravel between February and June. SR spring/summer Chinook exhibit a "stream" type juvenile life history pattern, rearing for one, or sometimes even two years in freshwater before migrating to the ocean from April through June. These smolts are often referred to "yearling" Chinook. Adults typically remain in the ocean for two or three years before returning to spawn (Matthews and Waples 1991).

SR Sockeye Salmon

Before the turn of the century (c. 1880), about 150,000 sockeye salmon ascended the Wallowa, Payette, and Salmon River basins to spawn in natural lakes (Evermann 1896). Sockeye populations in the Payette basin lakes were eliminated after a diversion dam near Horseshoe Bend was constructed in 1914, and Black Canyon Dam was completed in 1924. In 1916, a dam at Wallowa Lake was increased in height, resulting in the extinction of indigenous sockeye in Wallowa Lake. Sockeye salmon in the Salmon River occurred historically in at least four lakes within Idaho's Stanley basin: Alturas, Redfish, Pettit, and Stanley Lakes. Sunbeam Dam, 20 miles downstream from Redfish Lake, severely limited sockeye and other anadromous salmonid production in the upper Salmon River between 1910 to 1934 (Waples *et al.* 1991a). In the 1950s and 1960s, more than 4,000 adults returned annually to Redfish Lake. Between 1985 and 1987, an average of 13 sockeye were counted at the Redfish Lake weir. Only 10 sockeye have returned to Redfish Lake since 1994: One in 1994, one in 1996, one in 1998 and seven in 1999 (all of those returning in 1999 were 2nd generation progeny of wild sockeye that returned to Idaho in 1993). Since 1991, adult sockeye returning to Redfish Lake have been captured to support a captive broodstock program.

Historically, SR sockeye salmon adults entered the Columbia River in June and July, migrated upstream through the Snake and Salmon Rivers, and arrived at Redfish Lake in August and September. Spawning peaks in October and occurs in lakeshore gravels. Fry emerge in late April and May and move immediately to the open waters of the lake where they feed on plankton for one to three years before migrating to the ocean. Juvenile sockeye generally leave Redfish Lake from late April through May, and migrate nearly 900 miles to the Pacific Ocean. Although

pre-dam reports indicate that sockeye salmon smolts migrated in May and June, tagged sockeye smolts from Redfish Lake passed Lower Granite Dam from mid-May to mid-July. SR sockeye spend 2 to 3 years in the Pacific Ocean before returning to their natal lake to spawn.

SR Steelhead

Historically, SR steelhead spawned in virtually all accessible habitat in the Snake River up to Shoshone Falls (RM 615). The development of irrigation and hydropower projects on the mainstem Snake River have significantly reduced the amount of available habitat for this species. No valid historical estimates of adult steelhead returning to the Snake River basin before the completion of Ice Harbor Dam in 1962 are available. However, SR steelhead sportfishing catches ranged from 20,000 to 55,000 fish during the 1960s (Fulton 1970). The run of steelhead was likely several times as large as the sportfish take. Between 1949 and 1971, adult steelhead counts at Lewiston Dam (on the Clearwater River) averaged about 40,000 per year. The count at Ice Harbor Dam in 1962 was 108,000 and averaged approximately 70,000 per year between 1963 and 1970.

A recent 5-year geometric mean (1990 to 1994) for escapement above Lower Granite Dam was approximately 71,000. However, the wild component of this run was only 9,400 adults (7,000 A-run and 2,400 B-run). In recent years average densities of wild juvenile steelhead have decreased significantly for both A-run and B-run steelhead. Many basins within the Snake River are significantly under-seeded relative to the carrying capacity of streams (Busby *et al.* 1996).

Steelhead populations exhibit both anadromous (steelhead) and freshwater resident (rainbow or red-band trout) forms. Unlike other Pacific salmon species, steelhead are capable of spawning on more than one occasion, returning to the ocean to feed between spawning events. SR steelhead rarely return to spawn a second time. Steelhead can be classified into two reproductive types: Stream-maturing steelhead, which enter fresh water in a sexually immature condition and wait several months before spawning; and ocean-maturing steelhead, which return to freshwater with fully-developed gonads and spawn shortly thereafter. In the Pacific Northwest, stream-maturing steelhead enter fresh water between May and October and are referred to as "summer" steelhead. In comparison, ocean-maturing steelhead return between November and April and are considered "winter" steelhead. Inland steelhead populations in the Columbia River basin are almost exclusively of the summer variety (Busby *et al.* 1996).

SR steelhead can be further divided into two groupings: A-run steelhead and B-run steelhead. This dichotomy reflects the bimodal migration of adult steelhead observed at Bonneville Dam. A-run steelhead generally return to fresh water between June and August after spending 1 year in the ocean. These fish are typically less than 77.5 centimeters (cm) in length. B-run steelhead usually return to fresh water from late August to October after spending 2 years in the ocean and are generally greater than 77.5 cm in length.

Both A-run and B-run spawn the following spring from March to May in small to mid-sized streams. The fry emerge in 7 to 10 weeks, depending on temperature, and usually spend 2 or 3 years in fresh water before migrating to the ocean from April to mid-June. These estimates are

based on population averages and steelhead are capable of remarkable plasticity with in their life cycles.

Lower Columbia River (LCR) Chinook Salmon

The LCR Chinook salmon ESU includes all native populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. The former location of Celilo Falls (inundated by The Dalles reservoir in 1960) is the eastern boundary for this ESU. Stream-type, spring-run Chinook salmon found in the Klickitat River, or the introduced Carson spring-run Chinook salmon strain, are not included in this ESU. Spring-run Chinook salmon in the Sandy River have been influenced by spring-run Chinook salmon introduced from the Willamette River ESU. However, analyses suggest that considerable genetic resources still reside in the existing population (Myers *et al.* 1998). Recent escapements above Marmot Dam on the Sandy River average 2,800 and have been increasing (ODFW 1998).

Historical records of Chinook salmon abundance are sparse, but cannery records suggest a peak run of 4.6 million fish in 1883. Although fall-run Chinook salmon are still present throughout much of their historical range, most of the fish spawning today are first-generation hatchery strays. Furthermore, spring-run populations have been severely depleted throughout the ESU and extirpated from several rivers.

Apart from the relatively large and apparently healthy fall-run population in the Lewis River, production in this ESU appears to be predominantly hatchery-driven with few identifiable naturally-spawned populations. All basins are affected (to varying degrees) by habitat degradation. Hatchery programs have had a negative effect on the native ESU. Efforts to enhance Chinook salmon fisheries abundance in the lower Columbia River began in the 1870s. Available evidence indicates a pervasive influence of hatchery fish on natural populations throughout this ESU, including both spring- and fall-run populations. The large number of hatchery fish in this ESU make it difficult to determine the proportion of naturally-produced fish. The loss of fitness and diversity within the ESU is an important concern. The median population growth rate over a base period from 1980 through 1998 ranged from 0.98 to 0.88, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (McClure *et al.* 2000).

Upper Columbia River (UCR) Spring Chinook Salmon

The UCR ESU includes spring-run Chinook populations found in Columbia River tributaries between Rock Island and Chief Joseph Dams, notably the Wenatchee, Entiat, and Methow River basins. The populations are genetically and ecologically separate from the summer- and fall-run populations in the lower parts of many of the same river systems (Myers *et al.* 1998). Although fish in this ESU are genetically similar to spring Chinook in adjacent ESUs, they are distinguished by ecological differences in spawning and rearing habitat preferences. For example, spring-run Chinook in upper Columbia River tributaries spawn at lower elevations (500 to 1,000 m) than in the Snake and John Day River systems.

The UCR populations were intermixed during the Grand Coulee Fish Maintenance Project (1939 through 1943), resulting in loss of genetic diversity between populations in the ESU. Homogenization remains an important feature of the ESU. Fish abundance has tended downward both recently and over the long term. At least six former populations from this ESU are now extinct, and nearly all extant populations have fewer than 100 wild spawners.

Given the lack of information on Chinook salmon stocks that are presumed to be extinct, the relationship of these stocks to existing ESUs is uncertain. Recent total abundance within this ESU is quite low, and escapements in 1994 to 1996 were the lowest in at least 60 years. At least six populations of spring Chinook salmon in this ESU have become extinct, and almost all remaining naturally-spawning populations have fewer than 100 spawners. Extinction risks for UCR spring Chinook salmon are 50% for the Methow, 98% for the Wenatchee, and 99% for the Entiat spawning populations (Cooney 2002). In 2002, the spring Chinook count at Priest Rapids Dam was 34,083, with 24,000 arriving at Rock Island Dam. The 2002 count was about 67.6% and 242% of the respective 2001 and 10-year average adult spring Chinook count at Priest Rapids Dam.

<u>Upper Willamette River (UWR) Chinook Salmon</u>

The UWR Chinook salmon ESU includes native spring-run populations above Willamette Falls and in the Clackamas River. In the past, it included sizable numbers of spawning salmon in the Santiam River, the middle fork of the Willamette River, and the McKenzie River, as well as smaller numbers in the Molalla River, Calapooia River, and Albiqua Creek. Although the total number of fish returning to the Willamette has been relatively high (24,000), about 4,000 fish now spawn naturally in the ESU, two-thirds of which originate in hatcheries. The McKenzie River supports the only remaining naturally-reproducing population in the ESU (ODFW 1998).

There are no direct estimates of the size of the Chinook salmon runs in the Willamette River basin before the 1940s. The Native American fishery at the Willamette Falls may have yielded 908,000 kilograms of salmon (454,000 fish, each weighing 9.08 kg) (McKernan and Mattson 1950). Egg collections at salmon hatcheries indicate that the spring Chinook salmon run in the 1920s may have been five times the run size of 55,000 fish in 1947, or 275,000 fish (Mattson 1948). Much of the early information on salmon runs in the upper Willamette River basin comes from operation reports of state and Federal hatcheries.

Fish in this ESU are distinct from those of adjacent ESUs in life history and marine distribution. The life history of Chinook salmon in the UWR ESU includes traits from both ocean- and stream-type development strategies. Tag recoveries indicate that the fish travel to the marine waters off British Columbia and Alaska. More Willamette fish are recovered in Alaskan waters than fish from the LCR ESU. UWR Chinook salmon mature in their fourth or fifth years. Historically, 5-year-old fish dominated the spawning migration runs, however, recently most fish have matured at age 4. The timing of the spawning migration is limited by Willamette Falls. High flows in the spring allow access to the upper Willamette River basin, whereas low flows in the summer and autumn prevent later-migrating fish from ascending the falls. The low flows may serve as an isolating mechanism, separating this ESU from others nearby.

While the abundance of UWR spring Chinook salmon has been relatively stable over the long term and there is evidence of some natural production, at present natural production and harvest levels the natural population is not replacing itself. With natural production accounting for only one-third of the natural spawning escapement, natural spawners may not be capable of replacing themselves even in the absence of fisheries. The introduction of fall-run Chinook into the basin and the laddering of Willamette Falls have increased the potential for genetic introgression between wild spring- and hatchery fall-run Chinook. Habitat blockage and degradation are significant problems in this ESU.

The median population growth rate over a base period from 1980 through 1998 ranges from 1.01 to 0.63, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (McClure *et al.* 2000).

Columbia River (CR) Chum Salmon

Chum salmon of the CR ESU spawn in tributaries and in mainstem areas below Bonneville Dam. Most fish spawn on the Washington side of the Columbia River (Johnson *et al.* 1997). Previously, chum salmon were reported in almost every river in the lower Columbia River basin, but most runs disappeared by the 1950s (Rich 1942, Marr 1943, Fulton 1970). WDFW regularly monitors only a few natural populations in the basin, one in Grays River, two in small streams near Bonneville Dam, and the mainstem area next to one of the latter two streams. Recently, spawning has occurred in the mainstem Columbia River at two spots near Vancouver, Washington, and in Duncan Creek below the Bonneville Dam.

Historically, the CR chum salmon ESU supported a large commercial fishery in the first half of this century, landing more than 500,000 fish per year as recently as 1942. Commercial catches declined beginning in the mid-1950s, and in later years rarely exceeded 2,000 per year. There are now no recreational or directed commercial fisheries for chum salmon in the Columbia River, although chum salmon are taken incidentally in the gill-net fisheries for coho and Chinook salmon, and some tributaries have a minor recreational harvest (WDF *et al.* 1993). Observations of chum salmon still occur in most of the 13 basins/areas that were identified in 1951 as hosting chum salmon, however, fewer than 10 fish are usually observed in these areas. In 1999, the WDFW located another Columbia River mainstem spawning area for chum salmon near the I-205 bridge (WDFW 2000).

Chum salmon enter the Columbia River from mid-October through early December and spawn from early November to late December. Recent genetic analysis of fish from Hardy and Hamilton Creeks and from the Grays River indicate that these fish are genetically distinct from other chum salmon populations in Washington. Genetic variability within and between populations in several geographic areas is similar, and populations in Washington show levels of genetic subdivision typical of those seen between summer- and fall-run populations in other areas, and are typical of populations within run types (Salo 1991, WDF *et al.* 1993, Phelps *et al.* 1994, Johnson *et al.* 1997).

The median population growth rate is 1.04 over a base period from 1980 through 1998 for the ESU as a whole (McClure *et al.* 2000). Because census data are peak counts (and because the precision of those counts decreases markedly during the spawning season as water levels and turbidity rise), NOAA Fisheries is unable to estimate the risk of absolute extinction for this ESU.

Middle Columbia River (MCR) Steelhead

The MCR ESU occupies the Columbia River basin from above the Wind River in Washington and the Hood River in Oregon and continues upstream to include the Yakima River, Washington. The region includes some of the driest areas of the Pacific Northwest, generally receiving less than 40 cm of precipitation annually (Jackson 1993). Summer steelhead are widespread throughout the ESU; winter steelhead occur in Mosier, Chenowith, Mill, and Fifteenmile Creeks in Oregon, and in the Klickitat and White Salmon Rivers in Washington. The John Day River probably represents the largest native, natural spawning stock of steelhead in the region.

Estimates of historical (pre-1960s) abundance specific to this ESU are available for the Yakima River, which has an estimated run size of 100,000 (WDF *et al.* 1993). Assuming comparable run sizes for other drainage areas in this ESU, the total historical run size may have exceeded 300,000 steelhead (NOAA 2000a).

Most fish in this ESU smolt at two years and spend 1 to 2 years in salt water before re-entering freshwater, where they may remain up to a year before spawning (Howell *et al.* 1985). All steelhead upstream of The Dalles Dam are summer-run (Schreck *et al.* 1986, Reisenbichler *et al.* 1992, Chapman *et al.* 1994, Busby *et al.* 1996). The Klickitat River, however, produces both summer and winter steelhead, and age-2-ocean steelhead dominate the summer steelhead, whereas most other rivers in the region produce about equal numbers of both age 1- and 2-ocean fish. A non-anadromous form co-occurs with the anadromous form in this ESU, and information suggests that the two forms may not be isolated reproductively, except where barriers are involved.

Current population sizes are substantially lower than historic levels, especially in the rivers with the largest steelhead runs in the ESU, the John Day, Deschutes, and Yakima Rivers. At least two extinctions of native steelhead runs in the ESU have occurred (the Crooked and Metolius Rivers, both in the Deschutes River basin). For the MCR steelhead ESU as a whole, (NOAA 2000a) estimates that the median population growth rate over the base period (1990-1998) ranges from 0.88 to 0.75, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (McClure *et al.* 2000). In 2002, the count of Bonneville Dam steelhead totaled 481,036 and exceeded all counts recorded at Bonneville Dam since 1938, except the 2001 total, which was 633,464. Of the total return in 2002, 143,032 were considered wild steelhead (Fish Passage Center 2003).

LCR Steelhead

The LCR ESU encompasses all steelhead runs in tributaries between the Cowlitz and Wind Rivers on the Washington side of the Columbia, and the Willamette and Hood Rivers on the

Oregon side. The populations of steelhead that make up the LCR steelhead ESU are distinguished from adjacent populations by genetic and habitat characteristics. The ESU consists of summer and winter coastal steelhead runs in the tributaries of the Columbia River as it cuts through the Cascades. These populations are genetically distinct from inland populations (east of the Cascades), as well as from steelhead populations in the upper Willamette River basin and coastal runs north and south of the Columbia River mouth. Not included in the ESU are runs in the Willamette River above Willamette Falls (Upper Willamette River ESU), runs in the Little and Big White Salmon Rivers (Middle Columbia River ESU), and runs based on four imported hatchery stocks: Early-spawning winter Chambers Creek/lower Columbia River mix, summer Skamania Hatchery stock, winter Eagle Creek NFH stock, and winter Clackamas River ODFW stock (63 FR 13351 and 13352). This area has at least 36 distinct runs (Busby et al. 1996), 20 of which were identified in the initial listing petition. In addition, numerous small tributaries have historical reports of fish, but no current abundance data. The major runs in the ESU, for which there are estimates of run size, are the Cowlitz River winter runs, Toutle River winter runs, Kalama River winter and summer runs, Lewis River winter and summer runs, Washougal River winter and summer runs, Wind River summer runs, Clackamas River winter and summer runs, Sandy River winter and summer runs, and Hood River winter and summer runs (NOAA 2000a).

All runs in the LCR steelhead ESU have declined from 1980 to 2000, with sharp declines beginning in 1995 (NOAA Fisheries 2000). Historic counts in some of the larger tributaries (Cowlitz, Kalama, and Sandy Rivers) probably exceeded 20,000 fish; more recent counts have been in the range of 1,000 to 2,000 fish (NOAA 2000). Habitat loss, hatchery steelhead introgression, and harvest are the major contributors to the decline of steelhead in this ESU. For the LCR steelhead ESU, NOAA (2000) estimates that the median population growth rate over the base period (1990-1998) ranges from 0.98 to 0.78, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (McClure *et al.* 2000).

UWR Steelhead

The UWR steelhead ESU occupies the Willamette River and tributaries upstream of Willamette Falls, extending to and including the Calapooia River. These major river basins containing spawning and rearing habitat comprise more than 12,000 km² in Oregon. Rivers that contain naturally-spawning winter-run steelhead include the Tualatin, Molalla, Santiam, Calapooia, Yamhill, Rickreall, Luckiamute, and Mary's, although the origin and distribution of steelhead in a number of these basins is being debated. Early migrating winter and summer steelhead have been introduced into the upper Willamette River basin, but those components are not part of the ESU. Native winter steelhead within this ESU have been declining since 1971, and have exhibited large fluctuations in abundance.

Over the past several decades, total abundance of natural late-migrating winter steelhead ascending the Willamette Falls fish ladder has fluctuated several times over a range of approximately 5,000 to 20,000 spawners. However, the last peak occurred in 1988, and this peak has been followed by a steep and continuing decline. Abundance in each of year from 1993 to 1998, was below 4,300 fish, and the run in 1995 was the lowest in 30 years.

In general, native steelhead of the UWR are late-migrating winter steelhead, entering freshwater primarily in March and April. This atypical run timing appears to be an adaptation for ascending Willamette Falls, which functions as an isolating mechanism for UWR steelhead. Reproductive isolation resulting from the falls may explain the genetic distinction between steelhead from the upper Willamette River basin and those in the lower river. UWR late-migrating steelhead are ocean-maturing fish. Most return at age 4, with a small proportion returning as 5-year-olds (Busby *et al.* 1996). Willamette Falls (River kilometer 77) is a known migration barrier (NOAA 2000a). Winter steelhead and spring Chinook salmon historically occurred above the falls, whereas summer steelhead, fall Chinook, and coho salmon did not. Detroit and Big Cliff Dams cut off access to 540 kilometer (km) of spawning and rearing habitat in the North Santiam River. In general, habitat in this ESU has become substantially simplified since the 1800s by removal of large woody debris to increase the river's navigability.

Habitat loss, hatchery steelhead introgression, and harvest are the major contributors to the decline of steelhead in this ESU. For the UWR steelhead ESU, the estimated median population growth rate for 1990 to 1998 ranged from 0.94 to 0.87, decreasing as the effectiveness of hatchery fish spawning in the wild increased compared with that of fish of wild origin (McClure *et al.* 2000).

UCR Steelhead

This inland steelhead ESU occupies the Columbia River basin upstream from the Yakima River to the U.S./Canada border. Rivers in the area primarily drain the east slope of the northern Cascade Mountains and include the Wenatchee, Entiat, Methow, and Okanogan River basins.

Estimates of historical (pre-1960s) abundance specific to this ESU are available from fish counts at dams (NOAA 2000a). Counts at Rock Island Dam from 1933 to 1959 averaged 2,600 to 3,700, suggesting a pre-fishery run size exceeding 5,000 adults for tributaries above Rock Island Dam (Chapman *et al.* 1994, Busby *et al.* 1996). Lower Columbia River harvests had already depressed fish stocks during the period in which these counts were taken, thus, the pre-fishery estimate should be viewed with caution.

Habitat degradation, juvenile and adult mortality in the hydropower system, and unfavorable environmental conditions in both marine and freshwater habitats have contributed to the declines and represent risk factors for the future. Harvest in lower river fisheries and genetic homogenization from composite broodstock collection are other factors that may contribute significant risk to the UCR steelhead ESU.

The median population growth rate over a base period from 1990 through 1998 ranged from 0.94 to 0.66, decreasing as the effectiveness of hatchery fish spawning in the wild increased compared with that of fish of wild origin (McClure *et al.* 2000). In 2002, 15,286 steelhead were counted at Rock Island Dam, compared with the 2001 count of 28,602, and the 10-year average return of 9,165. Of the total steelhead counted at Rock Island Dam in 2002, 10,353 were wild steelhead (Fish Passage Center 2003).

Generalized Fish Use in the Lower Columbia River

Based on migratory timing, listed salmon and steelhead species likely will be present in the action area during the proposed construction period. The action area serves as rearing and saltwater acclimation habitat for juvenile salmon and steelhead, and migration habitat from adult salmon and steelhead. Juvenile and adult steelhead migrate year-round, with peak smolt out-migration occurring May through June, and peak adult emigration occurring January through June. Juvenile and adult sockeye salmon migrate April through August, with peak smolt out-migration occurring May through June, and peak adult emigration occurring June through July. Juvenile and adult Chinook salmon migrate year-round, with peak smolt out-migration occurring March through July, and peak adult emigration occurring March through October. Juvenile and adult chum salmon migrate October through May, with peak smolt out-migration occurring March through May, and peak adult emigration occurring October through November.

Critical Habitat

NOAA Fisheries designates critical habitat based on physical and biological features that are essential to the listed species. For this Opinion, NOAA Fisheries has designated critical habitat for SR sockeye salmon, SR spring/summer Chinook salmon, and SR steelhead. The essential features of designated critical habitat within the action area that support successful spawning, incubation, fry emergence, migration, holding, rearing, and smoltification for ESA-listed salmonid fishes include: (1) Substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food (primarily juvenile), (8) riparian vegetation, (9) space, and (10) safe passage conditions.

2.1.2 Evaluating Proposed Actions

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined by 50 CFR 402.02 (the consultation regulations). In conducting analyses of habitat-altering actions under section 7 of the ESA, NOAA Fisheries uses the following steps of the consultation regulations and when appropriate combines them with its Habitat Approach (NOAA Fisheries 1999): (1) Consider the biological requirements of the listed species; (2) evaluate the relevance of the environmental baseline in the action area to the species' current status; (3) determine the effects of the proposed or continuing action on the species; and (4) determine whether the species can be expected to survive with an adequate potential for recovery under the effects of the proposed or continuing action, the effects of the environmental baseline, and any cumulative effects, and considering measures for survival and recovery specific to other life stages. In completing this step of the analysis, NOAA Fisheries determines whether the action under consultation, together with cumulative effects when added to the environmental baseline, is likely to jeopardize the ESA-listed species. If so, step 5 occurs. In step 5, NOAA Fisheries may identify reasonable and prudent alternatives for the action that avoid jeopardy, if any exist.

The fourth step above requires a two-part analysis. The first part focuses on the action area and defines the proposed action's effects in terms of the species' biological requirements in that area (*i.e.*, effects on essential habitat features). The second part focuses on the species itself. It describes the action's effects on individual fish, or populations, or both, and places these effects

in the context of the ESU as a whole. Ultimately, the analysis seeks to answer the question of whether the proposed action is likely to jeopardize a listed species' continued existence.

2.1.3 Biological Requirements

The first step in the methods NOAA Fisheries uses for applying the ESA section 7(a)(2) to listed salmon is to define the species' biological requirements that are most relevant to each consultation. NOAA Fisheries also considers the current status of the listed species taking into account population size, trends, distribution and genetic diversity. To assess to the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list the species for ESA protection and also considers new data available that is relevant to the determination

The biological requirements of a listed species are population characteristics necessary for salmon and steelhead to survive and recover to naturally-reproducing population levels, at which time protection under the ESA would become unnecessary. These requirements are best defined as the attributes associated with viable salmonid populations. Viable salmonid populations are populations that have a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame. The attributes associated with viable salmonid populations include adequate abundance, productivity (population growth rate), population spatial scale, and genetic diversity (McElhany et al. 2000). These attributes are influenced by survival, behavior, and experiences throughout the life cycle and by all action affecting the species, and are therefore distinguished from the more specific biological requirements associated with the action area. However, it is important that the action-area effects be considered in the context of these species-level biological requirements when evaluating the potential for the species to survive and recover (i.e., in the context of the full set of human activities and environmental conditions affecting the species). Biological requirements may also be described as characteristics of the habitat for actions that primarily affect survival through habitat pathways.

The current status of each species (Table 1) indicates that the species-level biological requirements are not being met for any of the ESUs considered in this consultation. This indicates that improvements in survival rates (assessed over the entire life cycle) will be needed to meet species-level biological requirements in the future. NOAA Fisheries will assess survival improvements necessary in the life stages influenced by the proposed action after considering the environmental baseline, which is specific to the area affected by the proposed action. For this consultation, the biological requirements are habitat characteristics that would function to support successful adult migration, juvenile rearing and migration, and smoltification (see Table 1 for references).

2.1.4 Environmental Baseline

Over the past century, human activities have altered the range of physical forces in the action area. To a significant degree, the risk of extinction for salmon stocks in the Columbia River basin has increased because complex freshwater and estuarine habitats needed to maintain diverse wild populations and life histories have been lost and fragmented. Estuarine habitat has been lost or altered directly through diking, filling, and dredging, and also has been degraded through changes to flow regulation that affect sediment transport and salinity ranges of specific habitats within the estuary. Not only have salmonid rearing habitats been eliminated, but the connections among habitats needed to support tidal and seasonal movements of juvenile salmon have been severed.

The lower Columbia River estuary lost approximately 43% of its tidal marsh (from 16,180 acres historically to 9,200 acres today), and 77% of its historic tidal swamp habitats (from 32,020 acres historically to 6,950 acres today) between 1870 and 1970 (Thomas 1983). One example is the diking and filling of floodplains that were formerly connected to the tidal river. This practice eliminated large expanses of low-energy, off-channel habitat for salmon rearing and migrating during high flows. Similarly, diking of estuarine marshes and forested wetlands within the estuary removed most of these important off-channel habitats.

Within the lower Columbia River, diking, river training devices (*e.g.*, pile dikes, riprap), railroads, and highways have narrowed and confined the river to its present location. Between the Willamette River and the mouth of the Columbia River, diking, flow regulation, and other human activities have resulted in a confinement of 84,000 acres of floodplain that likely contained large amounts of tidal marsh and swamp. The lower Columbia River's remaining tidal marsh and swamp habitats are in a narrow band along the Columbia River and its tributaries' banks, and around undeveloped islands.

Historically, the upland area near the waste water treatment plant was a complex of salt marsh wetlands and low marsh/swamp/forested wetlands, with freshwater low marshlands in the area where streams entered the low marsh/swamp/forested wetlands near Alder Cove (CREDDP 1984). The area has been developed for commercial, residential, and light industrial uses over the past century. The area is a mix of isolated wetlands no longer connected to the Columbia River except by a tide gate that regulates the import of salt water. Conversion of the area has contributed to a substantial loss of estuarine habitat that served an important freshwater/saltwater transition zone for salmonid fishes.

2.1.5 Analysis of Effects

2.1.5.1 Effects of Proposed Action

Temporary Access Road Construction

A temporary access road would be constructed in the wetland (high marsh habitat) between the road (NE 5th Street) and the waste water treatment plant for construction equipment access to the

treatment plant to modify the existing treatment lagoons. Construction of the access road would require removal of up to 500 cy of earthen materials and placement of 1080 cy of rock. The 500 cy of material would be stockpiled in the wetland near the proposed temporary road. The wetland is on the backside of the flood control levee maintained by the Corps and is no longer connected to Alder Cove and the Columbia River. Since the wetland is disconnected from the Columbia River via the flood control levee, it no longer provides habitat for salmonid fishes, and therefore construction of the temporary access road is unlikely to have adverse effects on ESA-listed salmon or steelhead.

Waste Water Treatment Plant Construction

Construction of the separator dike would occur within the existing waste water treatment cells. Therefore, adverse effects to water quality, fish habitat, or ESA-listed fish are unlikely to occur from construction of the separator dike within the existing waste water treatment cells.

Construction Activities

Directional drilling equipment would be staged near the waste water treatment plant effluent pump station or within the waste water treatment plant cells. If the staging area is constructed outside of the waste water treatment plant cells, a cofferdam would be constructed to isolated to equipment from the wetland. Groundwater that enters the cofferdam would be pumped to the waste water treatment cells for treatment. Drilling fluids used for lubrication of the drill rig would be excavated and discharged into the waste water treatment cells and disposed off site. A catchment area consisting of a steel containment vessel would be established at the hole-through location in the Columbia River to minimize drilling fluids from entering the Columbia River. The pipeline would be pulled back using a barge anchored in the Columbia River. Fish may be killed, or more likely temporarily displaced, by in-water work activities. In-water construction activities (e.g., placement of the deep-water outfall in the stream channel, stream channel excavation, directional drilling) is likely to temporarily increase turbidity (defined as a measurement of relative clarity due to an increase in dissolved or suspended, undissolved particles) in the effluent dominated stream and Alder Cove. Potential effects from projectrelated increases in turbidity on salmonid fishes include, but are not limited to: (1) Reduction in feeding rates and growth, (2) increased mortality, (3) physiological stress, (4) behavioral avoidance, (5) reduction in macroinvertebrate populations, and (6) temporary beneficial effects. Potential beneficial effects include a reduction in piscivorous fish/bird predation rates, enhanced cover conditions, and improved survival conditions.

Increases in turbidity can adversely affect filter-feeding macroinvertebrates and fish feeding. At concentrations of 53 to 92 parts per million (ppm) (24 hours) macroinvertebrate populations were reduced (Gammon 1970). Concentrations of 250 ppm (1 hour) caused a 95% reduction in feeding rates in juvenile coho salmon (Noggle 1978). Concentrations of 1200 ppm (96 hours) killed juvenile coho salmon (Noggle 1978). Concentrations of 53.5 ppm (12 hours) caused physiological stress and changes in behavior in coho salmon (Berg 1983).

The use of heavy equipment to excavate and place 750 linear feet of above-grade pipe, crushed rock, concrete anchors, and anchor mats in the stream would be completed without the use

isolation measures. Therefore, in-water work is likely to increase turbidity, and these increases in turbidity are likely to increase physiological stress, physical injury (*e.g.*, gill abrasion), and potentially displace rearing juvenile salmon and steelhead. Directional boring, installation of the deep-water outfall pipeline, and restricting in-water work to 1 November through 28 February, when abundance of juvenile salmonid fishes is low, is likely to minimize, but not eliminate, the above effects on rearing juvenile salmon and steelhead.

Unnamed Stream Channel

Installation of the deep-water outfall in the stream channel on the wetland-side of the levee (station 0.+60± to station 10+15±) includes 470 cy of crushed rock to be used for backfill. The backfill footprint measures 5 feet in width and 2 feet in height. The stream channel measures approximately 12 feet in width by 4 feet in depth. Installation of 500 linear feet of pipeline and crushed rock would result in a net loss of 0.55 acres of stream habitat.

The deep-water outfall would continue above grade in the stream channel on the marsh-side of the levee for approximately 250 linear feet (station 12+00± to station 17+60±) before being installed below grade, and includes 125 cy of crushed rock to be used for backfill. The backfill footprint measures 5 feet in width and 2 feet in height. The stream channel measures approximately 22 feet in width by 6 feet in depth. Installation of the 250 linear foot (of the 900 linear feet of pipe in the stream on the marsh-side of the levee) above-grade section of pipe and crushed rock would result in a net loss of 0.76 acres stream habitat.

The existing stream channel on the wetland-side of the levee is degraded and has been regulated by tide gate, channelized, and used for effluent discharge. No fish surveys were conducted in the stream channel to evaluate potential fish use. Near the stream channel/salt marsh interface, there is a tide gate in the levee. No information was provided regarding fish passage and tide gate operations, but limited fish passage is likely since the tide gate does function to control effluent discharge into the Columbia River. The stream on the marsh-side of the levee is water quality limited for pollutants and temperature, but morphologically is in good condition. Installation of the pipeline would alter channel morphology potentially causing an increase in water temperature, thereby increasing the potential for temperature-related diseases and physiological stress. Water temperature is a function of both external factors, such as solar radiation, air temperature, precipitation and base flows, and internal factors such as width-to-depth ratios, groundwater inputs, and hyporheic exchange (Poole and Berman 2001). The proposed action could affect both sets of factors.

Juvenile salmon are likely to avoid waters with elevated temperatures and low dissolved oxygen. However, exposure to significant increases in temperature and decreases in dissolved oxygen, may cause harm to rearing salmon. The effects of increases in water temperature are likely to increase physiological stress on rearing juveniles. Increases in water temperature likely would decrease dissolved oxygen and lead to a potential pathway for disease, compounding the effects on rearing juveniles. This may reduce fitness and survival. While the probability of the effects are reasonably certain, the intensity of the effect is likely low.

Water Quality - Potential Spills

Operation of excavation equipment requires the use of fuel, lubricants, coolants, *etc.*, which if spilled into a waterbody could injure or kill aquatic organisms. The proposed action includes a spill containment and control plan, however, the Corps provided no details of the plan, therefore its potential effectiveness cannot be evaluated.

Conservation Measures

The proposed action includes several conservation measures (BA pp. 22-25) to minimize adverse effects to water quality, however, the Corps provided few details of the proposed conservation measures, therefore their potential effectiveness cannot be evaluated.

2.1.5.2 Effects on Critical Habitat

NOAA Fisheries designates critical habitat based on physical and biological features that are essential to the listed species. Essential features of designated critical habitat include substrate, water quality, water quantity, water temperature, food, riparian vegetation, access, water velocity, space and safe passage. Effects to critical habitat from these categories would be similar to the effects described above in sections 2.1.5.1 and 2.1.5.2.

2.1.5.3 Interrelated Actions

Water Quality - Effluent

NOAA Fisheries regards the effluent discharge as an interrelated action, as effects associated with the discharge of pollutants at this location into the Columbia River would not occur but for the installation of the deep-water outfall. Effects of the deep-water outfall include changes in water quality to the Columbia River due to changes in effluent discharge location, as well as the effects from the effluent constituents, *e.g.*, heat load, biochemical oxygen demand, and toxic pollutants on listed salmon and steelhead, and designated critical habitat. Effluent from the waste water treatment plant is discharged into the stream near the waste water treatment plant effluent discharge structure where it exports into Alder Cove.

The effluent discharge is regulated by the ODEQ through the National Pollution Discharge Elimination System. The ODEQ issues a permit that includes a defined mixing zone and waste load allocations for pollutants. The regulated mixing zone (RMZ) is comprised of two fields, the near-field and far-field, as well as boundary interactions. The near-field, or zone initial dilution, is an area defined to take the maximum concentrations of effluent and provide rapid mixing. This is the area where the criterion maximum concentration (CMC) is regulated. The far-field is an area where the criterion continuous concentration (CCC) is regulated. The RMZ is an area where the effluent receiving water is designed to rapidly mix effluent and river water so that pollutants meet water quality standards at the RMZ limits.

Effluent flow was modeled by Cosmopolitan Engineering Group, Incorporated to predict acute dilution and water quality for the maximum day (24-hour average) flow. Chronic dilution and

water quality were based on the maximum (30-day average) flow. The modeling results are represented in Table 2.

Table 2. Effluent flow criteria for the City's waste water treatment plant

Design Criteria	Effluent Flow (million gallons day-1)
Annual Average	1.1
Maximum Monthly	1.5
Maximum 24-Hour Average	2.3
Peak Instantaneous	4.7

Temperature

The Columbia River in the action area is on the ODEQ 303(d) list as water quality limited for temperature during the summer months. The water temperature criterion for the Columbia is 20.0°C plus a narrative provision that requires sufficiently distributed cold water refugia to protect waters designated for salmon and steelhead migration. The proposed deep-water outfall will discharge water up to 25°C. Effluent temperature data reported in the outfall pre-design report ranged from 22.1°C to 25°C. Elevated water temperatures can increase the rate at which energy is consumed for standard metabolism (Fry 1971), and can cause depletion of energy reserves owing to increased respiratory demands, protein coagulation, and enzyme inhibition in adult salmon (Idler and Clemens 1959, Gilhousen 1980). Juvenile salmon exposed to constant water temperatures greater than 18°C are highly susceptible to disease, such as Chondrococcus columnaris. Susceptibility to disease is a function of concentration of columnaris organisms, length of exposure, and temperature (EPA 2001) as well as age of individual (increased age, increased resistance). Coho salmon exposed to C. columnaris had a rapidly increasing rate of infection with increase in water temperatures above 12.2°C (Fryer and Pilcher 1974). For coho salmon, infection frequency was low at 12.2°C (3%), but was 49% at 15°C, and rapidly jumped to 100% at water temperatures greater than 20.6°C.

Acute thermal shock leading to death can be induced by rapid shifts in temperature (McCullough 1999). The effect of the shock depends on acclimation temperature, the magnitude of the temperature shift, and exposure time (Tang *et al.* 1987, as cited in McCullough 1999). Thermal shock can also indirectly increase mortality. Juvenile Chinook salmon and rainbow trout acclimated to 15 to 16° C and transferred to temperature baths in the range of 26 to 30° C suffered significantly greater predation than controls (Coutant 1973). Coho salmon and steelhead trout acclimated to 10° C and transferred to 20° C water suffered sublethal physiological changes including hyperglycemia, hypocholestorolemia, increased blood hemoglobin, and decreased blood sugar regulatory precision (Wedemeyer 1973). Areas of increased temperature are expected to be localized and in relatively deep water (minus 35 feet MLLW). Temperature-related effects to salmonid fishes are largely unquantifiable, but are likely since salmon and steelhead are typically found in the upper 40 feet of the water column,

and since the outfall-diffuser is at the interface of Alder Cove where river topography changes from minus 5 feet MLLW at cove's terminus to minus 35 feet MLLW at the deep-water outfall-diffuser terminus. Based on the data provided in the outfall pre-design report, and the above analysis, the probability of acute thermal shock is likely, but low.

Biochemical Oxygen Demand and Total Suspended Solids

Waste discharge limitations for biochemical oxygen demand (BOD) and total suspended solids (TSS) from the City's National Pollutant Discharge Elimination Permit are represented in Table 3.

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Table 3.	Waste	discharge	limitations
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Parameter	Average Effluent Concentrations - Monthly mg/L	Average Effluent Concentrations - Weekly mg/l	Monthly Average lb/day	Weekly Average lb/day	Daily Maximums lbs
BOD	30	45	112	169	225
TSS	50	80	188	300	375

Biochemical Oxygen Demand

The BOD is a measure of the concentration of oxidizable organic material in the effluent. The BOD determination is an empirical test of BOD5. High BOD lowers the concentration of dissolved oxygen (DO) in water, and toxicity could occur as a result of insufficient concentrations of DO. Reduced DO concentrations mean less oxygen is available for respiration, and a decrease in DO concentration can cause toxicity, in contrast to other parameters, for which an increase in concentration can cause toxicity.

A number of factors affect DO in receiving waters. The DO content of fresh water is about 14.6 mg/L for saturation at 0° C and decreases gradually with increasing temperature to 9.1 mg/L at 20° C and 7.5 mg/L at 30° C (Rand and Petrocelli 1985). Other factors that tend to decrease DO in receiving waters include aquatic microbial, plant, and animal respiration. Factors that tend to increase DO include the equilibrium between atmospheric oxygen concentrations and the concentration of DO in water, wind mixing, and photosynthesis by aquatic algae and higher aquatic plants.

Spatial variability in DO includes longitudinal, vertical, and temporal components (COE 1999). Typical depletion of DO downstream of a source of oxygen demand is approximated by a specific first-order decay curve to a sag point, and then recovery based on re-aeration. The shape of the curve is dictated by the magnitude of the demand, the nature of the substances exerting the demand, the water temperature, hydraulic factors, stream geometry, the background DO concentration, and the re-aeration potential of the reach downstream of the source (COE 1999). Longitudinal variability in DO concentrations can also be related to the locations of sediment

oxygen demand, stands of macrophytes, differences in re-aeration rates related to channel morphometry, the presence of blooms of phytoplankton or the presence of large numbers of respiring organisms in localized areas. Vertical variability in DO levels typically occurs when water is isolated at depth through thermal or density stratification. This isolation removes the potential for re-aeration of these waters while allowing for DO depletion through the settling into and decomposition of organic matter in the deep layers, which is additive to latent sediment oxygen demand. The DO concentrations vary over temporal time scales ranging from seasonal tohourly.

Low levels of DO in water can cause direct and indirect effects to fish as well as create additional stress by causing an increase in toxicity of metals. Sublethal effects of reducing DO below saturation can include metabolic, feeding, growth, behavioral, and productivity effects. Behavioral responses include avoidance of low DO sites or patches and curtailment of migration if DO levels drop too low across the entire river corridor. Physiological changes associated with low DO include elevation in both rate and amplitude of breathing, decreased heart rate, increased stroke volume of the heart, and altered metabolic rate (Ruggerone 2000). In situations where demand of DO exceeds input, fish kills may occur.

Productive streams exhibit diurnal cycles in water-column DO concentrations due to photosynthesis and respiration. Although fish can detect and will attempt to avoid reduced concentrations of DO, average measurements of DO do not reflect the damage that can occur during diurnal minima. Other important factors include the length and frequency of fish exposure to the low DO level. In several species studied, fish growth appeared to be determined by the daily minimum of DO, not the average or maximum. Studies reviewed (NOAA 1999b) indicate possible 5 to 20% reductions in growth of juvenile coho salmon between 6.5 to 8 mg/L DO. Reductions in DO can decrease swimming performance in both adult and juvenile fish, affecting the ability to migrate, forage and avoid predators (NOAA 1999b, Spence et al. 1996). Any reduction in DO below saturation at high water temperatures increases the risk of adverse affects to salmonids. Subyearling and smolt life stages are very sensitive to low DO. Dahlberg et al. (1968, as cited in ODEQ 1995) found that a reduction in DO to 7.5 mg/L resulted in a 5% reduction in swimming speed. Dahlberg noted that swimming speed declined markedly below 7 to 8 mg/L DO. The ecological significance of increased stress and reduced swimming ability has only recently been increasingly verified and associated with latent declines in production and survival (Wilkie et al. 1997, Wedemeyer et al. 1990, Budy et al. 2002).

Sublethal effects that occur below 8 mg/L may control survival and success of juvenile salmonids in nature through reduced growth and size observed in juvenile salmonids at DO concentrations below saturation. Swimming speed in juvenile salmon declines markedly below DO concentrations of 7 to 8 mg/L (NOAA 1999b). Results of several growth experiments summarized for coho salmon (Warren *et al.* 1973, as cited in ODEQ 1995) show that growth rate appears closely related to DO concentrations below 6.0 to 6.5 mg/L. The ODEQ's issue paper further reports that concentrations from near 8 to 6.5 mg/L resulted in measurable reductions in swim speed and maximum attainable growth and laboratory studies which have shown that blood

is not fully saturated with oxygen at levels near 6.5 mg/L and changes in oxygen transfer efficiency occur.

At elevated water levels, water temperatures work in synergy with DO concentrations to cause a range of adverse affects to salmonids. This range includes acute lethal toxicity, inability to complete essential foraging and predator avoidance behaviors, area avoidance, migration delays, increased stress, reductions in growth, and slower swimming speed. Low DO concentrations increase the acute toxicity of various toxicants such as metals and ammonia (Rand and Petrocelli 1985, NOAA 1999b). Also, toxicants may increase sensitivity to low concentrations of DO. For example, any toxicant which damages the gill epithelium can decrease the efficiency of oxygen uptake.

Based on the information above, a water-column DO concentration equal to or greater than 8.0 mg/L is required to meet the biological requirements of rearing, smoltifying, and migrating subyearling and yearling juveniles and migrating adult salmon and steelhead in receiving waters. Based on modeling results (outfall pre-design report, Figure 8), effluent discharge from the waste water treatment plant would result in a DO depletion of 0.10 mg/L, lowering DO from an ambient concentration of ≥ 7.2 mg/L to no less than 7.1 mg/L. Therefore, effluent discharge is likely to result in adverse effects similar to those described above.

Total Suspended Solids (TSS)

Factors affecting TSS concentrations and distributions in receiving waters, include: Flow rates, temperature, soil erosion, urban runoff, waste water and septic system effluent, decaying plants and animals, and bottom-feeding fish. The decrease in water clarity caused by TSS can affect the ability of fish to see and catch food. Suspended sediment can also clog fish gills, reduce growth rates, decrease resistance to disease, and prevent egg and larval development.

TSS primarily affects species within the aquatic environment. Four categories of effects resulting from exposure to TSS are recognized in fish: Lethal, paralethal, sublethal, and behavioral (Newcombe and Jensen 1996). These four effect categories are defined as follows: Lethal effects are those that result in mortality; paralethal effects are those that reduce the population in time, such as reduced growth rate; sublethal effects are reduced feeding rate or feeding success and physiological stress; and behavioral effects are avoidance, alarm, or movement from cover. Although concentration and duration of exposure are the primary drivers of TSS effects on fish, other factors influence the degree of the effects such as particle size and temperature. Particle size affects the ability of fish to clear the gills of TSS (Servizi and Martens 1987), and temperature affects tolerance to TSS by further stressing the animal (Servizi and Martens 1991).

Following discharge, the size of particles entrained in the receiving water varies with flow characteristics (*e.g.*, velocity, gradient, turbulence, temperature). Deposition of suspended sediment is related to particle size and diminished flow. Temperature stratification can prevent TSS from mixing with portions of water columns or extend its downstream attenuation. The

very fine particle fraction (<0.06millimeters) tends to stay in suspension for the length of the fluvial system. These suspended solids can directly cause toxicity to aquatic biota or can settle to the bottom of the receiving waterbody and cause toxicity to the benthic community that serves as a prey base for other aquatic biota.

Indirectly, the suspended solids affect other parameters such as temperature and DO. Because of the greater heat absorbency of the particulate matter, the surface water becomes warmer and this tends to stabilize the stratification (layering) in stream pools, embayments, and reservoirs. This in turn, interferes with mixing, decreasing the dispersion of oxygen and nutrients to deeper layers and altering the vertical stratification of heat in the water column (Wilber and Clarke 2001). High concentrations of TSS can block light from reaching submerged vegetation. As the amount of light passing through the water is reduced, photosynthesis slows down. Reduced rates of photosynthesis causes less DO to be released into the water by plants. If light is completely blocked from bottom dwelling plants, the plants will stop producing oxygen and will die. As the plants are decomposed, bacteria will use up even more oxygen from the water. Low DO can lead to fish kills. High TSS can also cause an increase in surface water temperature, because the suspended particles absorb heat from sunlight. This can cause DO levels to fall even further (because warmer waters can hold less DO), causing additive harm to aquatic life.

Large quantities of TSS in a waterbody often correlate with higher concentrations of bacteria, nutrients, pesticides, and metals in the water. These pollutants may attach to inorganic and organic particles on the land and be carried into waterbodies with stormwater or attach to particulates in effluent and be carried downstream. Pollutants bound to solids may settle to the bottom, or remain suspended through fluvial systems, and release into the water column at variable rates (Wilber and Clarke 2001, COE 1999).

The waste load allocation for TSS at the City's waste water treatment plant is 375 pounds daily¹ (maximum). This increase in TSS could reduce oxygen and light, increase adsorption of heat, reduce mixing and dispersion of the effluent plume in the mixing zone. The TSS increase could also irritate gill membranes with exposure or cause avoidance by salmon and steelhead of the mixing zone as it extends downstream over these distances. Adverse effects may occur directly on aquatic invertebrates, and indirectly via habitat modification. Effects of TSS on aquatic invertebrates may result from physical toxicity of the suspended solids themselves, or indirectly impact invertebrate populations by alteration of surficial sediment substrates after the suspended solids settle out of solution, resulting in changes in the species composition and abundances of benthic invertebrates.

Toxic Pollutants

Effluent sampling results from the City's waste water treatment plant from June 2002, July 2002, and August 2002 are represented in Table 4 (outfall pre-design report, p. 11).

Table 4. Effluent sampling results

Variable	Units	June	July	August
Ammonia	mg/L	0.08	0.13	0.26
Hardness (CaCo ₃)	mg/L	52.7	55.4	59.3
Mercury	ng/L	3.9	6.4	4.8
Arsenic	μg/L	0.6	0.8	0.5
Cadmium	μg/L	ND	0.08	ND
Copper	μg/L	4.7	6.5	3.2
Lead	μg/L	0.10	0.13	ND
Nickle	μg/L	1.3	1.5	0.8
Silver	μg/L	0.05	0.04	ND
Zinc	μg/L	ND	ND	ND

ND - Not Detected

Ammonia

ODEQ's water quality CMC value for ammonia in saltwater is 3600 μ g/L. ODEQ's water quality CCC value for ammonia in saltwater is 490 μ g/L. Assumptions used in the outfall predesign report: pH 8.2, temperature 20.1°C, and zero salinity. Effluent samples collected at the waste water treatment plant for ammonia were 80 μ g/L, 130 μ g/L, and 260 μ g/L, respectively. Using the formulae specified in the Environmental Protection Agency's 1999 update of ambient water quality criteria for ammonia, a CMC value of 3830 μ g/L was derived, and a CCC value of 1250 μ g/L was derived. The EPA's 1989 ambient water quality criteria for ammonia (saltwater), has three levels of salinity. Using the lowest level of salinity from the EPA saltwater criteria of 10 parts per thousand (ppt), a CMC value of 420 μ g/L was derived, and a CCC value of 620 μ g/L was derived. Salinity in the lower Columbia River in the area of the deep-water outfall-diffuser ranges from a low of 5 ppt to a high of greater than 30 ppt (CREDDP 1984). Based on the above analysis, the effluent discharged from the waste water treatment plant for ammonia is actually 620 μ g/L and exceeds the water quality CCC value of 490 μ g/L.

Ammonia, present in both ionized (NH₄⁺) and un-ionized (NH₃) forms in waterbodies, is more toxic to salmonid fishes in the un-ionized form (Wood 1993). Water pH, temperature, and ionic strength (Soderberg and Meade 1991) have an influence on ammonia toxicity by increasing the bioavailable fraction of un-ionized ammonia (Meade 1985). Ammonia toxicity is also dependent on water hardness in some aquatic organisms (Ankley *et al* 1995).

Concentrations of ammonia acutely toxic to fishes may cause loss of equilibrium, hyper-excitability, increased breathing, cardiac output and oxygen uptake (EPA 1986). In extreme

cases, damage to the central nervous system from acute levels can lead to convulsions, coma, and death (Randal and Tsui 2002). Other mechanisms of ammonia toxicity (Ruffer *et al.* 1981) include gill damage, leading to suffocation, osmoregulation dysfunction, kidney failure, and inhibition of ammonia excretion leading to neurological and cytological failure. At lower concentrations ammonia has many sublethal effects on fishes, including a reduction in hatching success, reduction in growth rate and morphological development, and pathologic changes in tissues of gills, livers and kidneys, and increased susceptibility to disease (Soderberg *et al* 1983, EPA 1986).

Based on the above analysis, it is likely that the effluent discharge for ammonia may cause sublethal effects in juvenile salmon and steelhead at the concentrations of 620 μ g/L.

Mercury

ODEQ's water quality CMC value for mercury in saltwater is 0.025 $\mu g/L$. ODEQ's water quality CCC value for mercury in saltwater is 2.1 $\mu g/L$. Effluent samples collected at the waste water treatment plant for mercury were 0.0039 $\mu g/L$, 0.0064 $\mu g/L$, and 0.0048 $\mu g/L$, respectively. Mercury at concentrations a low as 0.005 $\mu g/L$ total aqueous mercury can cause reproductive impairment in listed salmon and steelhead (NOAA 2000b).

Mercury exists naturally in the environment, however the difference between tolerable natural background levels and harmful levels is exceptionally small (Eisler 1977). Mercury is hazardous to fish because of its strong tendency to bioaccumulate in mussel tissue and the capacity for causing reproductive and central nervous system damage (Sorensen 1991, Wiener and Spry 1996). Organomercury compounds, especially methylmercury, are significantly more effective than inorganic mercury compounds in producing adverse effects and accumulation to dangerous levels (Eisler 1987). Chronic mercury poisoning symptoms include brain lesions, cataracts, diminished responsiveness, inability to capture food, abnormal motor coordination, and various erratic behaviors (Armstrong 1979).

At chronic levels, adverse effects to various metabolic functions have a direct effect on growth, development, reproduction, and general well-being of marine and freshwater biota (Eisler 1977). Rapid accumulation of mercury, caused by continuos direct exposure from the environment and magnified through the diet, can cause sublethal effects to listed salmon and steelhead. These effects can affect survival at all live stages and underestimate chronic toxicity levels while being persistent at even natural background concentrations (Ponce and Bloom 1991, EPA 1980,1985). The uptake of mercury is proportional to the concentration of mercury in water. Inorganic mercury is absorbed less readily, with intestinal absorption limited to a few percent, and eliminated more rapidly, than methylmercury, for which absorption is nearly complete (Scheuhammer 1987, Wiener and Spry 1996). Inorganic mercury appears to have the greatest effect on the kidneys, while methylmercury is a potent nervous system toxicant.

Since mercury at concentrations a low as $0.005~\mu g/L$ total aqueous mercury can cause reproductive impairment in listed salmon and steelhead, mercury discharged at concentrations

similar to those measured at the waste water treatment plant (0.0039 μ g/L to 0.0064 μ g/L) is likely to harm juvenile salmon and steelhead.

Arsenic

ODEQ's water quality CMC value for arsenic in saltwater is $69 \mu g/L$. ODEQ's water quality CCC value for arsenic in saltwater is $36 \mu g/L$. Effluent samples collected at the waste water treatment plant for arsenic were $0.6 \mu g/L$, $0.8 \mu g/L$, and $0.5 \mu g/L$, respectively. Birge *et al.* (1981) reported an LC₁₀ of 134 $\mu g/L$ for rainbow trout embryos after a 28-day exposure. Toxicity tests for adult and juvenile salmonid fishes indicate that chronic effects do not occur until concentrations are at least two orders of magnitude higher than the levels determined by Birge *et al.* (1981) to be detrimental to developing embryos. Arsenic concentrations discharged from the waste water treatment plant do not appear to cause harm to juvenile salmon and steelhead.

<u>Cadmium</u>

ODEQ's water quality CMC value for cadmium in saltwater is 43 μ g/L. ODEQ'S water quality CCC value for cadmium in saltwater is 9.3 μ g/L. Effluent samples collected at the waste water treatment plant for cadmium were 0.08 μ g/L, and two ND. Toxicity test data determined a 96 hour LC₅₀ for rainbow trout fry of 1.1 μ g/L (Anadu *et al.* 1989). This suggest that harm to listed salmon and steelhead is likely at concentrations well below 1.1 μ g/L, as an LC₅₀ means that 50% of the test organisms died. Cadmium concentrations discharged from the waste water treatment plant do not appear to cause direct harm to juvenile salmon and steelhead, but may cause sublethal effects.

Copper

ODEQ's water quality CMC value for copper in saltwater is 2.9 μ g/L. ODEQ's water quality CCC value for copper in saltwater is 2.9 μ g/L. Effluent samples collected at the waste water treatment plant for copper were 4.7 μ g/L, 6.5 μ g/L, and 3.2 μ g/L, respectively. All three of the effluent test samples exceed ODEQ's water quality CMC and CCC values, respectively.

Copper toxicity is influenced by chemical speciation, hardness, pH, alkalinity, total and dissolved organic content in the water, previous exposure and acclimation, fish species and lifestage, water temperature, and presence of other metals and organic compounds that may interfere with or increase copper toxicity. Synergistic toxicity is suggested for mixtures of copper and aluminum, iron, zinc, mercury, anionic detergents, or various organophosphorus insecticides (Eisler 1998). Biological copper toxicity has a diversity of systemic effects including reduced growth and survival rates and altered hematology, respiratory, and cardiac physiology. Reproductive effects, including reduced frequency of spawning, reduced egg production, reduced survival of young, and increased deformity of fry, have been reported (Sorensen 1991, Eisler 1998). Elevated copper levels also influence the immune system and vulnerability to disease. For example, Carballo et al. (1995) determined that rainbow trout were more susceptible to the microbial parasite, Saprolegnia parasitica, and Dethloff and Bailey (1998) determined physiological changes in immune system characteristics at elevated copper concentrations. Hansen et al. (1999) determined that cellular damage occurred to the olfactory system of juvenile Chinook salmon and rainbow trout that were exposed to high copper concentrations.

Copper toxicity appears to be inversely related to the tendency of the metal to bind with the external gill surface via ionic interactions. In other words, a lower affinity of the gill surface to copper leads to a greater likelihood of disruption of intracellular processes, which may lead to gill dysfunction (Reid and McDonald 1991). Some studies have examined the disruption of gill processes by copper. For example, gill Na^+ , K^+ ATPase activity in Chinook parr was unaffected after an 18 hour exposure to stream water with elevated copper levels of 48 μ g/L (hardness = 13.3 mg/L as CaCO₃). With the same exposure, significant inhibition of gill Na^+ , K^+ ATPase activity was observed in Chinook smolts. Significant increases in hematocrit and plasma glucose were also observed in both parr and smolts resulting from the same 18 hour exposure (Beckman and Zaugg 1988).

Available toxicity test data indicate that, under certain conditions, juvenile salmonids can be harmed by copper at concentrations just above the CMC value of 2.9 µg/L, and at concentrations that fall within the effluent sampling results from the waste water treatment plant. Welsh *et al* (2000) determined a 96 hour LC50 for rainbow trout fry of 3.4 µg/L at a hardness of 40 mg/L. They also determined an LC50 for Chinook salmon fry of 7.4 µg/L at a hardness of 40 mg/L, and an LC50 for rainbow trout fry of 17.2 µg/L at a hardness of 90 mg/L. However, because 50% of the test organisms died, it is likely that the effluent discharge for copper will harm some juvenile salmon and steelhead.

Lead

ODEQ's water quality CMC value for lead in saltwater is 140 μ g/L. ODEQ's water quality CCC value for lead in saltwater is 5.6 μ g/L. Effluent samples collected at the waste water treatment plant for lead were 0.10 μ g/L, 0.13 μ g/L, and one ND. Wong *et al.* (1981) reported an LC₁₀ of 3.5 μ g/L of tetramethyl lead for rainbow trout fry, and an incipient lethal limit of 24 μ g/L for juvenile rainbow trout. Data on the effects of inorganic lead on salmonid fishes indicate that mortality to embryos ranged from 2.5 μ g/L to 10.3 μ g/L (Birge et al. 1978, 1981), and adverse developmental effects occurred at concentrations ranging from 4.1 μ g/L to 146 μ g/L (Davies et al. 1976). Lead concentrations discharged from the waste water treatment plant do not appear to cause harm to juvenile salmon and steelhead.

Nickel

ODEQ's water quality CMC value for nickel in saltwater is 75 μ g/L. ODEQ's water quality CCC value for nickel in saltwater is 8.3 μ g/L. Effluent samples collected at the waste water treatment plant for nickle were 1.3 μ g/L, 1.5 μ g/L, and 0.8 μ g/L, respectively. Birge et al. (1978) reported a 30-day LC₅₀ for rainbow trout embryos of 50 μ g/L. The corresponding lethal threshold (LC₁) was estimated at 0.6 μ g/L. Giattina et al. (1982) reported that rainbow trout fry avoided a nickle concentration of 24 μ g/L. Nickel concentrations discharged from the waste water treatment plant do not appear to cause harm to juvenile salmon and steelhead.

Silver

ODEQ's water quality CMC for silver in saltwater is 2.3 μ g/L. There is no CCC for silver in saltwater. Effluent samples collected at the waste water treatment plant for silver were 0.05 μ g/L, 0.04 μ g/L, and one ND. Davies et al. (1978) reported a 96-hour LC₅₀ for juvenile rainbow

trout of 13 μ g/L at a water hardness of 350 mg/L. Silver concentrations discharged from the waste water treatment plant do not appear to cause harm to juvenile salmon and steelhead.

Zinc

ODEQ's water quality CMC for zinc in saltwater is 95 μ g/L. ODEQ's water quality CCC for zinc in saltwater is 86 μ g/L. Effluent samples collected at the waste water treatment plant for zinc all ND. Juvenile rainbow trout avoidance was reported at concentrations of 5.6 μ g/L at a hardness of 13 mg/L (Sprague 1968), and 47 μ g/L at a hardness of 112 mg/L (Birge and Black (1980). Since the effluent samples collected for zinc were non-detects, conclusions regarding effects of zinc discharged from the waste water treatment plant on salmonid fishes cannot be discounted, but zinc concentrations discharged from the waste water treatment plant do not appear to cause harm to listed salmon and steelhead.

2.1.5.4 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." NOAA Fisheries is aware of one specific future non-federal activity within the action area that would cause greater effects to listed species than presently occurs. Pacific Coast Seafood Company and Pacific Surimi Joint Venture, LLC, both discharge process waste water to the Skipanon Channel (Skipanon River). The seafood processing plants are considering connecting to the City's waste water treatment plant deepwater outfall. This alternative would collect and pump waste water from the two seafood processing plants and connect to the City's deep-water outfall. Waste water from the seafood processing plants would not be treated at the City's waste water treatment plant, only connected to the deep-water outfall for discharge into the Columbia River.

Effects from the seafood processing plants would be similar to those described in section 2.1.5.3. Information provided in the outfall pre-design report indicate that maximum daily discharge limitations would equal 55,500 pounds daily¹ for BOD, 28,700 pounds daily¹ for TSS, and 6,500 pounds daily¹ for oil and grease. Based on modeling results (outfall pre-design report, Figure 8), effluent discharge from the seafood processing plants would result in a DO depletion of 0.8 mg/L, lowering DO from an ambient concentration of ≥7.2 mg/L to more than 6.4 mg/L. As noted above, a water-column DO concentration equal to or greater than 8.0 mg/L is required to meet the biological requirements of rearing, smoltifying, and migrating subyearling and yearling juveniles and migrating adult salmon and steelhead in receiving waters. Therefore, if the Pacific Coast Seafood Company and the Pacific Surimi Joint Venture, LLC, alternative were connected to the City's waste water treatment plant deep-water outfall it would likely result in additional adverse water quality effects including increases in acute toxicity of various toxicants such as metals and ammonia, and lowering DO below saturation.

2.1.6 Conclusion

The fourth step in NOAA Fisheries' approach to determine jeopardy is to determine whether the proposed action, in light of the above factors, is likely to appreciably reduce the likelihood of the species' survival and recovery in the wild. For the jeopardy determination, NOAA Fisheries uses the consultation regulations, and its Habitat Approach (NOAA Fisheries 1999) to determine whether actions would further degrade the environmental baseline or hinder attainment of PFC at a spatial scale relevant to the listed ESU. That is, because the subject ESUs consist of groups of populations that inhabit geographic areas ranging in size from less than ten to several thousand square miles, the analysis must be applied at a spatial resolution wherein the actual effects of the action on the species can be determined.

After reviewing the best available scientific and commercial information available regarding the current status of SR steelhead, UCR steelhead, MCR steelhead, UWR steelhead, LCR steelhead, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon, UWR Chinook salmon, LCR Chinook salmon, CR chum salmon, and SR sockeye salmon, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, NOAA Fisheries concludes that the action, as proposed, is not likely to jeopardize the continued existence of the species listed above, and is not likely to destroy or adversely modify designated critical habitat for SR fall-run Chinook salmon, SR spring/summerrun Chinook salmon, and SR sockeye salmon.

Our conclusion is based on the following considerations: (1) In-water construction and its potential effects (*e.g.*, increases in turbidity) will occur at a time of year when abundance of adult and juvenile salmon and steelhead is likely to be low, minimizing, but not eliminating, adverse effects to listed salmon and steelhead; (2) effluent discharge of ammonia, mercury, and copper are likely to harm listed salmon and steelhead, but the magnitude of harm is unlikely to appreciably diminish reproduction, numbers, or distribution of listed salmon and steelhead, and is not likely to appreciably diminish critical habitat constituent elements; and the extent of effects from pollutants discharged from the deep-water outfall identified in section 2.1.5.3 likely do not extend more than 100 to 150 feet from the deep-water outfall; and (3) the effects of this action are not likely to impair currently properly functioning habitats, appreciably reduce the functioning of already impaired habitats, or retard the long-term progress of impaired habitats toward proper functioning condition essential to the long-term survival and recovery at the population or ESU scale.

2.1.7 Reinitiation of Consultation

This concludes formal consultation on these actions in accordance with 50 CFR 402.14(b)(1). Reinitiation of consultation is required: (1) If the amount or extent of incidental take is exceeded; (2) the action is modified (e.g., the Pacific Coast Seafood Company and the Pacific Surimi Joint Venture, LLC alternative is added) in a way that causes an effect on the listed species that was not previously considered in the BA and this Opinion; (3) new information or project monitoring reveals effects of the action that may affect the listed species in a way not

previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

2.1.8 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitats, or to develop additional information. The following conservation recommendation is consistent with these obligations, and therefore should be carried out by the Corps for the proposed action:

- 1. The Corps should modify the existing tide gate in the flood control levee to comport with NOAA Fisheries (2003) draft tide gate guidelines and criteria, and include at a minimum the following design and operational parameters:
 - a. A side-hinged tide gate installed in the culvert.
 - b. The gate is installed with a latch or locking pin (manual or pressure sensitive) that maintains an opening of approximately 90° to the axis of the culvert until incoming tides are at an elevation of +5 MLLW
 - c. The maximum water surface drop at the entrance and exit of the culvert-tide gate is 0.5 feet throughout the tidal cycle.
 - d. Culvert-tide gate velocities do not exceed 1 feet second⁻¹ from March 1 through September 30 of a given year. From October 1 through February 28, culvert-tide gate velocities shall not exceed 4 feet second⁻¹.

To be kept informed of actions minimizing or avoiding adverse effects, or those that benefit listed salmon and their habitats, NOAA Fisheries requests notification of any actions leading to the achievement of the conservation recommendation.

2.2 Incidental Take Statement

The ESA at section 9 [16 USC 1538] prohibits take of endangered species. The prohibition of take is extended to threatened anadromous salmonid fishes by section 4(d) rule [50 CFR 223.203]. Take is defined by the statute as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." [16 USC 1532(19)] Harm is defined by regulation as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering." [50 CFR 222.102] Harass is defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering." [50 CFR 17.3] Incidental take is defined as "takings that result from, but are not the purpose of, carrying out an

otherwise lawful activity conducted by the Federal agency or applicant." [50 CFR 402.02] The ESA at section 7(o)(2) removes the prohibition from any incidental taking that is in compliance with the terms and conditions specified in a section 7(b)(4) incidental take statement [16 USC 1536].

2.2.1 Amount or Extent of Take

The proposed action covered by this Opinion is reasonably certain to result in incidental take of listed species due to effects from construction activities, in-stream work (e.g., excavation, installation of the deep-water outfall, placement of 2,969 cy of rock), and water quality (from construction-related activities only). Effects of actions such as these are largely unquantifiable in the short term, but are likely to be largely limited to harm in the form of injury and behavior modification. Therefore, even though NOAA Fisheries expects some low level of incidental take to occur due to the action covered by this Opinion, the best scientific and commercial data available are not sufficient to enable it to estimate a specific amount of incidental take. In instances such as these, NOAA Fisheries designates the expected level of take in terms of the extent of take allowed. Therefore, the extent of take for this Opinion is limited to take resulting from activities undertaken as described in this Opinion that occurs in the action area (defined as all estuarine and riverine habitats accessible to the subject species in the Columbia River from river mile 10 to river mile 11 south of the Federal navigation channel, and includes the unnamed tributary, the adjacent riparian zone, and Alder Cove), except for the RMZ and take associated with pollutants discharged by the City's waste water treatment plant at the deep-water outfalldiffuser because of the limited regulatory authority by the Corps. The extent of take includes all accessible habitats to SR steelhead, UCR steelhead, MCR steelhead, UWR steelhead, LCR steelhead, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon, UWR Chinook salmon, LCR Chinook salmon, CR chum salmon, and SR sockeye salmon. Incidental take occurring due to modifications to the proposed action or beyond the area described is this Opinion are not authorized by this consultation.

2.2.2 Reasonable and Prudent Measures

The following reasonable and prudent measures are necessary and appropriate to minimize take of the above species from implementation of the proposed action. The Corps shall ensure that:

- 1. The extent of incidental take is minimized by ensuring that the proposed conservation measures for are fully implemented.
- 2. A comprehensive monitoring and reporting program is completed to verify that use of the conservation measures are effective at avoiding and minimizing the extent of take from permitted activity.

2.2.3 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above for each category of activity. These terms and conditions are non-discretionary.

- 1. To implement reasonable and prudent measure #1 (conservation measures), the Corps shall ensure that conservation measures and best management practices proposed as part of the proposed action (BA p. 22-25) are fully implemented, except as modified below.
 - a. All in-water work (defined as all work below top-of-bank) shall take place from November 1 through February 28 of a given year. No in-water work shall take place outside the in-water work period without prior written authorization from NOAA Fisheries.
 - b. All disturbed ground are planted with native plantings, e.g., Populus balsamifera spp tricharpa, (black cottonwood), Thuja plicata (western red cedar), Salix hookeriana (coast willow), and Lonicera involucrata (twinberry).
 - c. No herbicides shall be applied.
 - d. Plantings must be self-perpetuating with a survival rate or plant cover of 80%. If plantings are not self-perpetuating with the required survival rate or cover within five years, then the Corps shall submit a plan for establishment of vegetation at the project site.
- 2. To implement reasonable and prudent measure #2 (monitoring), the Corps shall ensure that:
 - a. A monitoring plan to evaluate effects of the proposed action is submitted to NOAA Fisheries for review and approval no later than 120 days following project completion.
 - b. The action is carried out as proposed by monitoring and recording project implementation.
 - c. The implementation of proposed conservation measures, the success or failure of the measures, and actions taken to correct failures of the measures are monitored and recorded.
 - d. The extent, duration, and frequency of any turbidity plumes related to project activities, and efforts made to control turbidity, are monitored and recorded.
 - e. Accidental spills of hazardous materials, and efforts made to control any such spills, are monitored and recorded.
 - f. The survival of vegetation plantings is monitored and recorded. Once plantings are established with the required survival or cover rate (see 1.d above), then no monitoring is required.
 - g. Any observed injury and/or mortality of fish resulting from project implementation is monitored and recorded.

- h. The condition of the project sites, upstream and downstream, before and following construction of each project-specific element are monitored using photo-documentation.
 - i. Photo stations shall be established so the entire construction site can be recorded
 - ii. Photos shall be taken of the construction site before any construction activities.
 - iii. Photo-documentation of the construction site shall be taken at high and low tides throughout the construction/outfall pipe installation period. Photo-documentation shall be taken daily at the end of work.
- i. Water quality in the stream is monitored and recorded.
 - i. Water temperature shall be reported as daily minimum, daily maximum, and running 7-day average of the daily maximum for each week (*i.e.* per the protocol of the ODEQ).
- j. A monitoring report addressing the data required above shall be submitted annually, by December 31 of a given year, to:

National Marine Fisheries Service Oregon State Habitat Office Habitat Conservation Division

Attn: 2003/01504525 NE Oregon Street, Suite 500
Portland, OR 97232

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

3.1 Background

Pursuant to the MSA:

- NOAA Fisheries must provide conservation recommendations for any Federal or state action that would adversely affect EFH (§305(b)(4)(A)).
- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NOAA Fisheries EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are

used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10). "Adverse effect" means any impact which reduces quality and/or quantity of EFH, and may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). EFH consultation with NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action would adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects on EFH.

3.2 Identification of EFH

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of federally-managed Pacific salmon: Chinook (*O. tshawytscha*); coho (*O. kisutch*); and Puget Sound pink salmon (*O. gorbuscha*) (PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other waterbodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years). EEH also has been designated for groundfish species and coastal pelagic species. The estuarine EFH composite includes those waters, substrates and associated biological communities within bays and estuaries of the EEZ, from mean higher high water level (MHHW) or extent of upriver saltwater intrusion to the respective outer boundaries for each bay or estuary as defined in 33 CFR 80.1 (Coast Guard lines of demarcation). Detailed descriptions and identifications of EFH are contained in the fishery management plans for groundfish (PFMC 1999), coastal pelagic species (PFMC 1999a), and Pacific salmon (PFMC 1999b). Casillas *et al.* (1998) provides additional detail on the groundfish EFH habitat complexes.

3.3 Proposed Action

The proposed action is detailed in sections 2.1.5.1, 2.1.5.2, and 2.1.5.3 of this document. For this consultation, NOAA Fisheries defines the action area as all estuarine and riverine habitats accessible to the subject species in the Columbia River from river mile 10 to river mile 11 south of the Federal navigation channel, and includes the unnamed tributary, the adjacent riparian zone, and Alder Cove. This area has been designated as EFH for various life stages of coastal pelagic species, groundfish species, and Chinook and coho salmon (Table 5).

3.4 Effects of Proposed Action

The proposed action will adversely affect water quality for coastal pelagic species, groundfish species, and Chinook and coho salmon due to increased concentrations of suspended sediment and turbidity, potential spills of toxic materials, and reduced water quality.

3.5 Conclusion

The proposed action will adversely affect the EFH for coastal pelagic species, groundfish species, and Chinook and coho salmon.

3.6 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations for any Federal or state agency action that would adversely affect EFH. NOAA Fisheries recommends the Corps implement the conservation recommendations and terms and conditions in the ESA consultation.

3.7 Statutory Response Requirement

Please note that the MSA (section 305(b)) and 50 CFR 600.920G) requires the Federal agency to provide a written response to NOAA Fisheries after receiving EFH conservation recommendations within 30 days of its receipt of this letter. This response must include a description of measures proposed by the agency to avoid, minimize, mitigate or offset the adverse effects of the activity on EFH. If the response is inconsistent with a conservation recommendation from NOAA Fisheries, the agency must explain its reasons for not following the recommendation.

3.8 Supplemental Consultation

The Corps must reinitiate EFH consultation with NOAA Fisheries if the action is substantially revised or new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920).

Table 5. Species with designated EFH in the estuarine EFH composite in the state of Oregon.

Groundfish Species	
Leopard Shark (southern OR only)	Triakis semifasciata
Soupfin Shark	Galeorhinus zyopterus
Spiny Dogfish	Squalus acanthias
California Skate	Raja inornata
Spotted Ratfish	Hydrolagus colliei
Lingcod	Ophiodon elongatus
Cabezon	Scorpaenichthys marmoratus
Kelp Greenling	Hexagrammos decagrammus
Pacific Cod	Gadus macrocephalus
Pacific Whiting (Hake)	Merluccius productus
Black Rockfish	Sebastes maliger
Bocaccio	Sebastes paucispinis
Brown Rockfish	Sebastes auriculatus
Copper Rockfish	Sebastes caurinus
Quillback Rockfish	Sebastes maliger
English Sole	Pleuronectes vetulus
Pacific Sanddab	Citharichthys sordidus
Rex Sole	Glyptocephalus zachirus
Rock Sole	Lepidopsetta bilineata
Starry Flounder	Platichthys stellatus
Coastal Pelagic Species	
Pacific Sardine	Sardinops sagax
Pacific (Chub) Mackerel	Scomber japonicus
Northern Anchovy	Engraulis mordax
Jack Mackerel	Trachurus symmetricus
California Market Squid	Loligo opalescens
Pacific Salmon Species	
Chinook Salmon	Oncorhyncus tshawytcha
Coho Salmon	Oncorhyncus kisutch

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